SUSITNA-WATANA HYDRO

Meeting Notes
Initial Study Report (ISR) Meetings
Glacial (Study 7.7), Geomorphology (Studies 6.5 + 6.6), Water Quality (Studies 5.5-5.7), Groundwater (Study 7.5)
March 23, 2016

LOCATION: Cook Inlet Region Inc.
725 E Fireweed Ln
Anchorage, AK 99503

TIME: 8:30 am to 4:30 pm AKDT Time

SUBJECT: ISR Meeting Summary- March 23, 2016

Goal: Describe the status of Study Plan implementation and explain any variances and proposed modifications to ongoing studies for completion of the Study Plan.

Attendees: **Betsy McGregor** AEA, **Bryan Carey** AEA, **Doug Ott** AEA, **Dan Smith** AEA, **Wayne Dyok** H2O EcoPower, **Julie Anderson** DMS, **Matt Love** VNF, **Steve Padula** McMillen Jacobs, **Kathryn Peltier** McMillen Jacobs, **Sydney Hamilton** ATD, **Sunny Morrison** ATD
Bill Fullerton Tetra Tech, **Lyle Zevenbergen** Tetra Tech, **Rob Plotnikoff**, Tetra Tech, **Jon Zufelt** HDR, **Dudley Reiser** R2, **Phil Hilgert** R2, **Paul Dworian** AECOM, **Steve Swope** Pacific Groundwater Group
David Turner FERC, **Matt Cutlip** FERC, **Ken Hogan** FERC,
Dirk Pedersen Stillwater Sciences, **Matthew Burak** Louis Berger, **Fred Winchell** Louis Berger, **Tyler Rychener** Louis Berger, **Tim Ruga** AKRF, **Jay Stallman** Stillwater Sciences
Joe Klein ADF&G, **Marie Steele** DNR, **William Ashton**, DEC, **Melissa Hill**, DNR
Betsy McCracken USFWS, **Douglass Cooper** USFWS, **Sue Walker** NMFS, **Sean Eagan** NMFS, **Chris Holmquist-Johnson** USGS, **Hal Geiger** St. Hubert Research Group, **Jeff Davis** ARRI, **Felix Kristanovich** Ramboll Environ, **Jason Mouw** Floodplain Resources, **Jim Munter**, JA Munter Consulting, Inc., **Jose (Pepe) Vasquez**, NHC
Matthew LaCroix EPA, **Cassie Thomas** National Park Service
Becky Long Susitna River Coalition, **Mike Wood** SRC, **Emily Anderson** Wild Salmon Center, **George Kalli**, **Ellen Lockyer** Ak Public Media

On Phone: **Jon Ludwig** Tetra Tech**, Harry Gibbons** Tetra Tech, **Rui Zou**Tetra Tech, **Mike Harvey** Tetra Tech **Dawn Chapel** Pacific Groundwater Group, **David Wampler** Pacific Groundwater Group, **Kathy Dube** Watershed GeoDynamics, **Michael Lilly** GW Scientific, **Bill Miller** Miller Ecological
Paul Makowski FERC, **Woohee Choi** FERC, **Monir Chowdhury** FERC,
Dirk Pedersen Stillwater, **Peter Foote** Louis Berger, **Solomon Gbondo-Tugbawa** Louis Berger, **Andrea Ray** NOAA, **Greg Auble** USGS, **Leanne Hanson** USGS, **Meg Pinza** Ramboll Environ, **Greg**

Ruggerone NRC, **Dave Mclean** Northwest Hydraulics
Heide Lingenfelter Ahtna, Inc., **Whitney Wolff** Talkeetna Community Council, **Jan Konigsberg** Alaska Hydro Project, **Cameron Wobus** Stratus Consulting

Introduction

As part of the Federal Energy Regulatory Commission's (FERC) Integrated Licensing Process (ILP), Alaska Energy Authority (AEA) is required to hold meetings with licensing participants and FERC to discuss the study results and AEA's plans to modify the Study Plan as outlined in the Initial Study Report (ISR). The ISR Parts A, B, and C for each study were filed with the FERC on June 3, 2014. For many studies, additional information was filed in technical memoranda September through December 2014. In the fall of 2015, Study Implementation Reports (SIR) and Study Completion Reports (SCR) were filed with FERC to report on the status or in some cases completion of studies since the previous ISR filings. ISR Part D, filed on November 6, 2015, provided a "roadmap" of the various components of each study, updates to the study progress, variances, modifications, and steps to complete the study. The ISR Meetings were held in Anchorage over five days, March 22, 23, 25, 29 and 30, 2016, covering the 58 FERC-approved Study Plans for the Susitna-Watana Project.

The following meeting notes are for the March 23rd meeting and intended to capture any significant discussion/information in addition to the materials provided on the Project website (http://www.susitna-watanahydro.org/). The meeting agenda and presentations are available under the "previous meetings" tab (link provided under the meetings tab) on the Project website.

After introductions Steve Padula, McMillen Jacobs, presented a brief overview of the history of major filings and milestones of the Project and an updated FERC schedule. AEA will file the ISR Meeting Summary April 24, 2016. Licensing participants file requests for modifications to the existing Study Plan or requests for new studies June 23, 2016. Steve reviewed the regulatory requirements for requesting a study plan modification to an existing study or a new study, and made reference to the poster boards in the room. AEA and other licensing participants file responses to the requests August 22, 2016. FERC will make its study plan determination on the meeting summaries and any disagreements or recommendations for modified or new studies by October 21, 2016. These details are in the "Introduction to ISR Meetings" presentation.

6.5 Geomorphology Study

Bill Fullerton, Tetra Tech, provided an overview of the objectives, components, variances, modifications, and a summary of the results. In addition to the June 2014 ISR, four tech memos were filed in August 2014, two additional tech memos were filed in November 2014 and the 2014-2015 SIR, which included the Delineation and Geomorphic Characterization tech memo (SIR Attachment 1), was filed November 4, 2015. Study Components 2, 4, 5 and 7 have been completed as well as data collection in the Middle and Lower River. The rest of the study remains to be completed. There were 4 decision points from the RSP that have been made (Slides 16-18).

AEA proposed six modifications to the Study Plan (Slides 19-21): 1) effective discharge in the Middle River will not be calculated due to its supply limited nature; 2) use of the 1-D bed evolution model sediment transport results to calculate effective discharge in the Lower River instead of using sediment transport rating curves; 3) replacement of the Grantt et al. (2003) framework for analyzing the downstream impact of the Project with the framework for 1st and 2nd order analysis of dam effects on river morphology; 4) elimination of the Modified Braiding Index (MBI) for the

Middle River because the planform does not consist of dynamic multiple bar-braided channels within a braid plain; 5) elimination of the MBI in the Lower River; and 6) addition of 1-D bed evolution model to determine the depositional characteristics of the sand and larger sediment fractions of sediment inflow to the upper end of the reservoir.

Becky Long, SCR, commented that the literature review conducted by this study was well done and very useful for this study and appreciated its use for other areas as well.

Questions were raised (Becky Long, SRC) on extending Bed Evolution Modeling (BEM) to Susitna Station (PRM 29.9), but not below. The decision to extend BEM to Susitna Station was based on the stream flow assessment and not extending below that point was based on changes in flow, sediment, and hydraulics as part of Study 6.6.

Becky Long, SRC, commented on the glacial surge analysis, referencing the November 2014 tech memo, the subsequent December 2014 technical meeting and requested meeting notes. She inquired if the study of reservoir sedimentation from glacial surge represents future conditions related to climate change. Mike Harvey, Tetra Tech, explained that the potential change in reservoir life was based on the additional sediment that could reach the reservoir as buffered by the extensive braid plains below the glaciers. Subsequent communication with Dr. Harrison, who first brought up concerns about glacial surges, revealed that his position was that with climate change glacial surge would be less of an issue because the glaciers would be able to maintain a mass balance without surging. The December 2014 Technical Meeting notes on this topic can be found on AEA's website http://www.susitna-watanahydro.org/meetings/past-meetings/.

Becky Long, SRC, asked if aerial surveys had been conducted of the Denali East Corridor. Betsy McGregor, AEA, indicated that aerial imagery had been collected and the mapping of that area is underway. Kathy Dube, Watershed GeoDynamics, confirmed that she had conducted aerial reconnaissance of the new corridor.

David Mclean, NHC, noted the comprehensive and extensive amount of material describing baseline conditions but not on Project effects. These are primarily addressed in the reconnaissance level assessment and model integration, which are preliminary at this time. David Mclean inquired if the baseline without-Project was being considered the same as the future without-Project and suggested that both would need to be known to assess Project impacts. Bill Fullerton, Tetra Tech, clarified that AEA was not projecting future conditions without-Project 200 years into the future. AEA is basing the study on existing conditions, and is evaluating trends into the next 50-years.

Comments were made (David Mclean, NHC) related to uncertainty analysis and bracketing impacts using different methods, and how the Peace River showed primarily lateral changes. Uncertainty is being addressed in part by Study 6.6. So far one operational scenario has initial results. David Mclean asked if uncertainty analysis would be clearly communicated and translated throughout all other studies/models using these results as input. Bill Fullerton, Tetra Tech, clarified that this will occur and that the various studies are working on the details.

Regarding AEA's proposed modification to not calculate effective discharge in the Middle River, David Mclean, NHC, inquired what would be used as an alternative to evaluate change in width. Effective discharge calculations were initially made, but now the Study 6.6 modeling results will be used to provide a more detailed analysis. Because the Middle River is not alluvial and has a very coarse immobile bed during open-water conditions, the change in channel width would be vegetation driven and not attributed to geomorphic change.

Regarding the variance of not obtaining aerial imagery at 5,000 cfs, Sean Eagan, NMFS, expressed the value of images at that flow as a truthing tool and to see which channels would be dry, noting the amount of the year that the Project

would be ramped between 5,000 and 12,000 cfs. Due to weather and seasonal flow trends it is very difficult to obtain aerial photos for this flow level; it was unsuccessfully attempted multiple years. In the 1980s, aerial images were used, but the analysis performed was static, unlike the current modeling approach being used which is not static. Bill Fullerton, Tetra Tech, replied that as part of the modeling, a joint effort carried out under the Fluvial Geomorphology Study (Study 6.6) and the Riparian Instream Flow Study (Study 8.6), breaching flows at lateral habitats, primarily in the Middle River, would be surveyed. He noted all of the observations and level logger data that have been gathered at various flows providing insight into connectivity. The use of modeling, level loggers, and future surveys of breaching elevations are going to address this flow range.

Sean Eagan, NMFS, inquired if changes to tributary deltas as a result of the with-Project low flows not being able to move the sediment delivered by tributaries was being evaluated. Bill Fullerton, Tetra Tech, indicated that under the Fluvial Geomorphology Modeling Study (Study 6.6), existing and with-Project scenarios were being modeled to evaluate the impact to tributary deltas. Several tributaries within Focus Areas will be 2-D modeled and others have been selected for 1-D modeling. Bill referred Sean to the SIR for Study 6.6 (filed with FERC November 2015) which presents an example of the analysis at one of the tributaries.

Sean Eagan, NMFS, indicated that he was impressed with the method used to determine Manning's N in the center of the channel during the winter with below-water photographic bed sampling (Study 6.6). He inquired if the data could be presented to show the variance across the channel or see if it was consistent. This would depend on whether the sampling was more perpendicular across or along the channel and the extent; ice stability was a concern in determining sample sites. AEA agreed to review the winter bed sampling data to see if it can be presented to show the variation of Manning's N across the channel.

A question was raised (Greg Ruggerone, NRC) about how Study 9.12 relies on Studies 6.5 and 6.6 relative to fish passage into tributaries, what tributaries are included, and what information is being provided. The Study 6.6 ISR Part C Table 7.1-1 (http://www.susitna-watanahydro.org/wp-content/uploads/2014/06/06.6_GEOMOD_ISR_PartC.pdf) lists the tributaries that are included in relation to Study 9.12 and the SIR for Study 6.6 provides an example of analyzing tributary fan development in the appendix. There has been significant coordination between the two studies.

Action Item

6.6-1. AEA will review the winter bed sampling data to see if it can be presented to show the variation of Manning's N across the channel. In response to this action item, AEA produced an addendum to the technical memorandum *Winter Bed Sampling of Main Channel Bed Material* (Tetra Tech 2014). The addendum includes maps showing the locations of each auger hole used to photograph the channel bed where water was flowing under the ice cover. The addendum (*Addendum 1. Main Channel Bed Material Sampling Points*) was filed as Attachment 8 to Transmittal of Meeting Summary and Action Items of Alaska Energy Authority, Project No. 14241-000 (filed April 24, 2016).

6.6 Fluvial Geomorphology Modeling below Watana Dam Study

Lyle Zevenbergen, Tetra Tech, provided an overview of the objectives, components, variances, modifications, and a summary of the results. In addition to the June 2014 ISR, two tech memos were filed September 2014, and the 2014-2015 SIR, which included the Fluvial Geomorphology Modeling Development tech memo (SIR Attachment 1), was filed November 2015. Data collection has been completed and the modeling is ongoing. Several decision points from

the RSP have been made (Slide 10), including the selection of the Focus Areas, tributaries, and representative hydrology, as well as the decision to not extend the 1-D BEM below PRM 29.9, as outlined in the Decision Point on Fluvial Geomorphology Modeling of the Susitna River below PRM 29.9 TM (September 26, 2014).

AEA proposed seven modifications to the Study Plan (Slides 11 and 12): 1) use of Ackers White transport function instead of Wilcock Crowe; 2) inclusion of groundwater sources in FA-128 hydraulic models; 3) not considering PDO for selection of hydrology for representative wet, average and dry years; 4) excluding dimensionless critical shear as a parameter for the sensitivity analysis; 5) exclusion of Bank Energy Index (BEI) for channel bank erosion as ice breakup is primary driver; 6) extension of BEM modeling time period as necessary to evaluate tributary fan development; and 7) future decision to identify specific 2-D modeling scenarios at Focus Areas.

A question was raised (Jeff Davis, ARRI) about potential channel aggradation and flooding potential of the town of Talkeetna. Existing conditions show more aggradation than with-Project conditions and many peak flows would be reduced, thereby reducing flooding potential.

Questions were raised (Betsy McCracken, USFWS) about significant findings of the literature review, it's applicability to the reach below PRM 29.9, and if there are rules-of-thumb (Sean Eagan, NMFS) about how long it takes for rivers to respond to dams. Mike Harvey, Tetra Tech, explained that an important finding from the literature review was, though there are certain responses that may be typically associated with a dam, exactly which responses will occur for a particular project are river-specific and the analysis needs to be river-specific.

There were additional questions (Betsy McCracken, USFWS) on the decision to not extend bed evolution modeling below PRM 29.9. The decision was based on comparing changes in several parameters (flows, velocity, depth, sediment transport, and channel width) due to the Project compared to the natural variability. Project-related change was small in comparison to the wide range of natural variability. A follow up question (Jim Munter, JA Munter Consulting, Inc.) related to the absence of an existing condition (a peak flow, for example). There would also be small relative changes in peak flows compared to the large natural variability.

Concerns were raised (Jose Vasquez, NHC) about running the models using the input files posted on the project website and getting different results than were reported. (Note: Due to extremely large output file sizes, the input files and the HEC-RAS software (Beta 5.0 version) were posted so reviewer and licensing participants could run the models and reproduce the results. The input files represent separate Middle and Lower Susitna River models that were run for Existing conditions and Max LF-OS1b conditions, each for 50-years. The HEC-RAS version was a Beta 5.0 version from June 2014 provided by the USACE that was used in the analysis.) Lyle Zevenbergen, Tetra Tech, noted that the posted model results were compared with USGS data and compared very well. He also cautioned that running the model with different versions may cause differences if the input files are not entirely compatible with the software versions. (Subsequent to the meeting it was determined that the commenter was obtaining comparable results using the input files and the Beta 5.0 version of HEC-RAS software posted to the website, which was the software available at the time of the analysis. Review of the SIR should be limited to the software available at the time of and actually used in the analysis to maintain compatibility of input files and software.)

Concerns were raised (Jose Vasquez, NHC) about the use of pass through nodes in the models, that in the bedrock-controlled reach of Devils Canyon this would be reasonable, but elsewhere it may inhibit bed evolution. Lyle Zevenbergen, Tetra Tech, explained that this was identified in the SIR Attachment 1 and is related to limitations of the HEC-RAS model Beta 5.0 version available at the time of the modeling. Pass through nodes were used at split

flows in the Middle River and at junctions in the Lower River due to instability and shortcomings of the software. Tetra Tech worked with USACE to fix the instability problem within the Beta 5.0 version of the model. These areas are planned to be fully mobile in the final versions of the models using the most recent releases of the HEC-RAS model available.

Clarification was made relative to a comment (Jose Vasquez, NHC) about the planned uncertainty analysis. As indicated in the RSP, Study 6.6 would perform a sensitivity analysis to address uncertainty.

Concerns were raised (Jose Vasquez, NHC) about the use of different transport functions in different models. Because the Middle and Lower Rivers have distinctly different characteristics, the use of different transport functions is reasonable and probably necessary. The software for the Focus Area modeling includes different transport functions than the reach-scale modeling, so there is no choice. No problems have been encountered with this approach.

Comments were made (Cassie Thomas, National Park Service) about vegetation encroachment in combination with channel geometry and width changes in the Middle and Lower Rivers. Lyle Zevenbergen, Tetra Tech, referred to Figure 5.1-3 in the *Decision Point on Fluvial Geomorphology Modeling of the Susitna River below PRM 29.9 Tech Memo* (September 26, 2014). In the Lower River hydraulic geometry relationships were used and indicated up to 6 percent narrowing below PRM 29.9 and up to 10 percent above PRM 29.9. For the Middle River changes in flow are being considered for narrowing from vegetation encroachment.

Comments were made (Sean Eagan, NMFS) on changing models, the availability of model updates, and how the Open Water Flow Routing Model, Bed Evolution Model and Ice Processes 1-D model have different cross section spacing. One version of the Bed Evolution Model has been provided. It will be updated and the updated version provided at the applicable milestones. Models for different studies are developed to evaluate specific processes and have specific cross section requirements that need to be followed.

Clarification was then requested (Sean Eagan, NMFS and followed up by Chris Holmquist-Johnson, USGS) on interdependency of the models, including bed evolution changes being reflected in the other models. There is not an individual cross section interdependence between models, but more of a reach process and looking at trends. This is also true between the reach-scale and local scale Bed Evolution Models.

Questions were raised (Sean Eagan, NMFS) on the use of large 2012 and 2013 floods for model validation. These time periods were used for hydraulic calibration and validation. Bed Evolution was evaluated using 50 years of historical data including the available 1980s data.

Clarification was requested (Jason Mouw, FRC) on the “non-alluvial” characterization of the Middle River. Mike Harvey, Tetra Tech, explained that the reference to “non-alluvial” was directed at the channel bed behavior. Though the river is formed in alluvium, the characterization was that the Middle River bed is relatively rigid with predominantly fine sediments in transport that collect in floodplain and island areas, primarily upstream of constrictions. As indicated by the 60-year record, bank erosion into the finer deposited sediments appears to be relatively small for this size river due to the coarse toe and dense root structure. Since erosion occurs very slowly and the Project would remove energy by decreasing the peak flows, erosion rates post-Project would be less than they are now.

After a question on tributary sediment (Cameron Wobus, Stratus Consulting), it was clarified that tributary sediment data collection is complete and that sediment measurements by the USGS were ceased on the Susitna River at Tsusena Creek due to safety and that the USGS was not measuring sediment transport on Tsusena Creek.

Questions were raised (Matthew LaCroix, EPA) on the potential for greater sediment transport in the winter due to higher winter flows. Wintertime sediment transport is expected to remain very low but will be considered in coordination with Study 7.6. Bank Erosion from breakup will also be considered. Jon Zufelt, HDR, added that increases in discharge in the winter will provide higher water levels and possibly higher velocity, but he anticipates that to occur predominately in the main channel.

Observations were made (Mike Woods, SRC) on the confluence area of the Susitna, Chulitna, and Talkeetna Rivers, how it's thought that the Susitna and Talkeetna Rivers keep the Chulitna directed away from the town of Talkeetna, and whether the modeling accounts for that. To the extent that the 1-D BEM includes the three rivers it accounts for sediment transport conditions in the Three Rivers Confluence area, though it does not differentiate each river once they are combined.

It was clarified (Whitney Wolff, Talkeetna Community Council) that a request had been made by the Talkeetna Community Council for 2-D modeling of the confluence area and that FERC approved 1-D modeling and whether relationships have been identified. Currently the Talkeetna and Chulitna Rivers are flow and sediment sources and will be included as reaches in the updated 1-D model to evaluate these relationships.

Clarification was made regarding a question (Sean Eagan, NMFS) that the 1-D BEM is intended to be evaluated on a reach scale and not individual bars or islands. Potential effects on islands are to be addressed more from 2-D modeling efforts at the Focus Areas.

Questions were raised (Becky Long, SRC) on the licensing process and when reporting project effects model results would be available, in the USR or the Draft License Application. Betsy McGregor, AEA, responded that the modeling of potential scenarios was an iterative process, where developing optimal scenarios for various resources would be balanced. Ultimately, the impact assessment would be in the Draft License Application. (It was later clarified during the meeting that the USRs for the riverine modeling studies would include the model output for baseline conditions and one operational scenario).

Sue Walker (NMFS) stated that NMFS will be submitting a model integration study request.

A suggestion was made (Chris Holmquist-Johnson, USGS) for a pilot study to put together results from all the river and aquatic habitat related modeling studies.

7.7 Glacier and Runoff Changes Study

Bryan Carey, AEA, provided an overview of the objectives, components, variances, modifications, and a summary of the results. There were two components to the FERC-approved Study Plan: 1) literature review relevant to glacier retreat in Southcentral Alaska and the Upper Susitna Watershed; and 2) evaluation of the potential for additional sediment loading to the Watana Reservoir from glacial surge. The first component was completed and reported in the June 2014 ISR. The second component was completed and reported in the *Assessment of the Potential for Changes in Sediment Delivery to Watana Reservoir Due to Glacial Surges Tech Memo*, filed with FERC November 14, 2014. There was a decision point related to the second component of the study; if the evaluation indicated that

substantial quantities of sediment load would be delivered to the reservoir from glacial surge, then a more detailed analysis of the increased loading would be performed and a sediment loading scenario accounting for glacial surge would be added to the reservoir trap efficiency and sediment accumulation analysis. It was determined that no further geomorphic investigations were warranted for flow or sediment production from glacial surges. There have been no variances from the Study Plan. AEA proposes no modifications to the FERC-approved Study Plan, as this study is considered complete.

Andrea Ray, NOAA, provided comments to a report for a study other than the FERC-approved Study Plan for Study 7.7. In addition to the FERC-approved Study Plan, AEA had commissioned Department of Natural Resources, Department of Geological and Geophysical Sciences to complete a climate change modeling study in the Upper basin. The report can be found at http://www.susitna-watanahydro.org/wp-content/uploads/2015/10/GlacierRunoffChangesStudy_FSR_FINAL_20151028.pdf. The two reports share the same literature review. Andrea Ray complimented the work that had been done and indicated that the literature review was very comprehensive. The remainder of her technical comments were appreciated, but are beyond the scope of the FERC-approved Study Plan and the ISR Meetings.

Sue Walker, NMFS, agreed that the work that had been done was excellent. She commented that NMFS is very interested in the climate induced physical changes on the watershed both with and without the project and particularly the biological responses to physical changes. These are important in the alluvial geomorphology studies and in many other studies. NMFS will be submitting a study modification request that considers all the new information since July 2013.

Mike Wood, SRC, commented that historically he had seen several glaciers in the Eastern Alaska Range change quickly and was wondering about more recent surges. Bryan Carey, AEA, said that the last time the Susitna Glacier surged was in the 1950s and was thought to have about a 50-year return period. It has not surged since. There's a question if it will surge again since the terminus has a lot of potholes which tends to be an indication of stagnation. Even if it did surge there are the Denali Flats of 90 miles which are relatively low gradient. So if a large amount of water and sand is discharged, the sand would settle in the 90 miles of flat before the reservoir. A surge year cannot be differentiated in the hydrological records.

5.5 Baseline Water Quality Study

Rob Plotnikoff, Tetra Tech, provided an overview of the objectives, components, variances, modifications, and a summary of the results. In addition to the June 2014 ISR, the 2013 and 2014 data and associated DVRs were filed with FERC November 14, 2014. Data collection has been completed and a Study Completion Report was filed with FERC November 2015. AEA proposes no modifications to the FERC-approved Study Plan, as this study is considered complete.

Comments related to the acceptability of select parameters in the 2013 water quality data set were made (Felix Kristanovich, Ramboll Environ). Specifically, reference was made to the large number of samples rejected during the quality assurance review for establishment of baseline conditions and for calibration of the water quality models (riverine and reservoir). There is an impression from the Study Completion Report (Study 5.5) that only a small number of samples were rejected so there appears to be a contradiction. Felix asked AEA to elaborate on why select samples were rejected.

The SCR contains a summary of quality assurance (QA) issues, the total number of samples collected, and the number of samples that did not meet acceptance guidelines for both 2013 and 2014 sample collection effort. QA issues are separated by year and summarized in two tables; Table 5.1-1 (2013 QA review results) and Table 5.1-2 (2014 QA review results). The proportion of rejected data from 2013 monitoring differed between baseline water quality monitoring and Focus Area monitoring. The number of rejected samples was almost equal for both monitoring programs, but the total number of samples was much smaller from the Focus Area monitoring and rejected data represented a larger proportion for this component of Study 5.5.

The number of rejected samples from 2013 are replaced by data re-collected during 2014, reviewed using the quality assurance acceptance limits and finalized for addition to the 2013 data set. Both years of monitoring data and QA review represent one full year of water quality monitoring data collectively. Since there were less rejections in the 2014 data that replaced the rejected 2013 data, the overall number of rejected samples from the complete 2013-2014 dataset is less.

Felix Kristanovich, Ramboll Environ, noted that in 2013, there were issues with two labs that provided different results. He asked how that was resolved in 2014.

Select water quality parameters were rejected from the 2013 data set because they did not meet acceptance limits for a lab performance measure called “matrix spikes”. This was the basis for further review of some nutrients and total metals data where the analytical results showed a recovery of these parameters that was much greater than the concentration in the matrix spike sample. This meant for select nutrients and metals results, that concentrations were reported much higher than were actual concentrations in the sample and was the basis for running a split lab sample set during one of the sampling events in 2013.

Differences in 2013 split lab sample results demonstrated that lab technique in sample preparation for analysis was a factor. This discovery prompted a sampling design involving collection and analysis of samples during 2014 for the purpose of determining concentrations of select nutrients and total metals reflecting expected ranges for this type of riverine setting. The correction of lab analysis results using a correction factor for each of the parameters was developed based on isolation of solids and turbidity that were detected as the target analyte.

Laboratory tests showed that the sediment (or turbidity) of a water sample can become part of a complex associated with reagents used to bind with target analytes (e.g., total phosphorus). When these solids (some containing a notable quantity of arsenic) are unusually high in a water sample, reagents combine with elements like arsenate as part of the solids and the complex is detected as TP. The analytical method for detecting total phosphorus (TP) was used to analyze isolated solids from the water sample and showed that about eighty percent of the estimated TP concentration in the whole sample was falsely detected in solids (sediment and turbidity). A secondary method (EPA method 200.8) used for analyzing solids confirmed the amount of TP estimated from false detection (~80 percent). A third confirmation for testing corrected TP concentrations that were acceptable was use of the Redfield ratio; where Total N/Total P concentrations are normally 16:1. The corrected estimates for TP concentration for 2014 samples is confirmed correct using the above tests.

A comment on the Study Completion Report (SCR 5.5) indicated that it did not contain sufficient detail to be a standalone document (Felix Kristanovich, Ramboll Environ). Examples of elements missing from this document would be supporting literature (e.g., literature citations) that provide perspective on conditions measured in the Susitna Basin and explanations for observations made from water quality monitoring. Study 5.5 SCR was intended to describe

current baseline water quality conditions for comparison with future modeling results and for calibration of the water quality models (Study 5.6). The purpose for this study did not include an explanation of sources and causes for existing water quality conditions that would require supporting literature.

Comments were made referring to data quality issues encountered in 2013 not being described in the SCR outside of the tables where exceedances of sample holding times or sample transport temperatures were reported (Felix Kristanovich, Ramboll Environ). Felix also commented that a description of the consequences to data quality was not explained in the report. AEA noted that data not meeting acceptance limits including concentrations outside of expected ranges from 2013 was re-collected during 2014 and reviewed before it was finalized and posted to the public web site. The finalized data set met all QA acceptance limits and is available for further use in calibration of the water quality models and to establish baseline (Pre-Project) conditions.

Felix Kristanovich, Ramboll Environ, commented that there was a contradictory statements about the Thermal Infrared (TIR) imaging in previously filed documentation and that it appears the effort was suddenly discontinued. As described in the presentation, the TIR imaging included all 10 Focus Areas, 9 additional areas of interest along the Middle River, and 73% of the Lower River, down to PRM 12. TIR data was not collected in an area of the Lower River downstream of the Talkeetna River due to persistent poor weather conditions, despite repeated attempts

Dudley Reiser, R2, explained that the TIR imaging was an extension of the 1980s effort to identify areas of potential groundwater upwelling and downwelling that could be related to fish use, habitat spawning conditions, and identify areas to focus HSC data collection. TIR imaging was a more sophisticated approach than was applied in the 1980s. This information will be used in the groundwater and fisheries resource studies.

Felix Kristanovich, Ramboll Environ, inquired if the decision to collect single grab-samples at select locations in 2014 based on the assumption that there was no horizontal or vertical variability observed in the 2013 samples was valid if many of the 2013 samples were rejected. Rob Plotnikoff, Tetra Tech, confirmed that the approach was valid. The 2014 water samples were collected at one location from the center and top of transects instead of at several locations (laterally and at depth) at each of the baseline water quality sites (like the 2013 water sampling strategy). This decision was made on the basis of water quality results from the 2013 sampling and examination of variability of measurements for each parameter. Since little to no variability occurred from top to bottom or side-to-side in the channel for parameter measurements during 2013, a decision was made to collect a single grab sample from each baseline water quality transect in 2014 and use these results to replace rejected data from the same transects visited in 2013. Focus Area water quality monitoring occurred at several (usually three) surface locations across transects and at point locations on side-channels and sloughs. The combination of the 2014 data with 2013 data are now considered a complete and valid data set.

Felix Kristanovich, Ramboll Environ, noted the density of transects for baseline water quality monitoring appeared to be sparse in some areas, with 30-mile reaches between transects where data have not been collected. He was concerned if this would affect water quality model calibration and the ability to accurately predict conditions in these areas.

Rob Plotnikoff, Tetra Tech, explained that data collection sites were based on repeating some of the monitoring that had occurred in the 1980s and capturing the effects of the tributaries. Some transects had been placed at locations where the 1980s data were collected and other transects were located to measure the effect of tributaries of the Susitna River. For major tributaries, data was collected within the tributary as well. Continuous temperature probes

were placed at more than double the number of water quality sites and to collect information between transects where the 30-mile reach occurs. There are no major water inputs between the largely spaced transects.

Jeff Davis, ARRI, expressed concern that longitudinal sampling for dissolved oxygen (DO) concentrations in Focus Area 128 (Slough 8A) was insufficient to obtain adequate baseline data in each habitat type. His concern was the lack of DO data beyond the two-100 m reaches centered on each "point sample" location. Jeff commented that a large difference in oxygen saturation can occur between the upstream point versus the downstream end of Slough 8A (where Slough 8A diverges from the main channel to where it re-joins the side channel) and influence useable habitat by coho salmon. Jeff recommended a study modification to obtain baseline water quality sampling longitudinally in replicates of each of these macrohabitat types in the Middle River that are important for rearing salmon. Rob Plotnikoff, Tetra Tech, responded that the reported results indicate that there very was little variation within the one hundred-meter increment. Dudley Reiser, R2, noted that in addition to the water quality baseline characterization (Study 5.5), there has been a lot of DO, temperature, pH and other water quality data collected seasonally, including the winter, as part of the HSC data collection effort.

5.6 Water Quality Modeling Study

Jon Ludwig, Rui Zou, and Sen Bai of Tetra Tech provided an overview of the objectives, components, variances, modifications, and a summary of the results. In addition to the June 2014 ISR, a tech memo was filed September 30, 2014 and the 2014-2015 SIR was filed November 6, 2015. Data collection has been completed (Study 5.5), spatial configuration of the EFDC model has been completed and calibration of the model is ongoing. The decision point from the RSP (Slide 14) to not extend the EFDC modeling below PRM 29.9 has been made, as outlined in the *Water Quality and Lower River Modeling Decision Point TM* (September 30, 2014). There have been no variances from the Study Plan. AEA proposes no modifications to the Study Plan.

Felix Kristanovich, Ramboll Environ, said he would like to see more model calibration statistics (in the form of general statistics) for the purpose of evaluation of model performance; a second item regarding performance is to conduct model validation to determine predictive capacity over different time periods. In addition to these items, he would like to see a more comprehensive description of the model study methods along with the calibration report and more detail on how the water quality model connects with the other models. Model calibration, validation and integration is ongoing; these will be reported when the tasks have been completed. These details will include longitudinal profiles of temperature along the river.

Felix Kristanovich, Ramboll Environ, noted the distance between water quality transects can be large and he was concerned that this could affect the hydrodynamic portion of the water quality model. A longitudinal profile of the model displayed as a graph will assist in evaluating how well the model predicts conditions at locations on the river where there is greater distance between data collection sites. Felix Kristanovich indicated that he would identify locations on the river where distances between monitoring sites is of concern to him.

Betsy McCracken, USFWS, asked how the 2013 and 2014 data sets were combined for the modeling effort and if there are expected differences from having data collected from two years to make up a complete data set. It was clarified that the only work that has been done thus far is calibration of the hydrodynamics with temperature data from 2012 and 2013. The hydrodynamic and temperature components of the model are key in eventually calibrating individual water quality variables like the nutrients and the hydrodynamic calibration has been performed. However, the water quality parameters have not yet been calibrated in the model. With respect to the 2013 and 2014 data, the

rejected 2013 data would not be used in model calibration as the model output would not reflect actual conditions. Quality assured data is the primary requirement for use in model calibration and for ensuring that model output reflects actual conditions. Representation of water quality conditions collected from the same time in two different years does not affect model performance.

Sue Walker, NMFS, asked about use of temperature data for developing the reservoir data and if predictions for the example scenarios take into account future projected air temperatures. Future reservoir conditions are based on continuous historical weather data (e.g., air temperature, precipitation, solar radiation) from the calibrated model. After calibration, the 1974–1976 and 1979–1981 periods were run with the reservoir present in the system to simulate potential future wet and dry years and to simulate how downstream water temperature is affected in historic wet and dry years with the reservoir present. The models only predict water temperature conditions in the reservoir and riverine areas based on available weather data. Long periods of record for temperature and hydrologic conditions were used to construct the framework of the models to account for climate and hydrologic cycles that influence water quality conditions like temperature. Once the model framework is initially constructed, it is validated with current data and re-calibrated to improve model performance. The cyclic variations in climate and hydrology are likely to occur in the future and so represent future potential conditions.

It was confirmed for Matt LaCroix, EPA, that the model is able to simulate spillway releases. Matt LaCroix asked about the capability of the model to anticipate ice-free conditions immediately downstream of the dam and the effect on water quality. Currently, modelers are reviewing and planning how to interface with the ice model to evaluate questions such as the possibility of ice-free conditions immediately downstream of the dam. There was a question if the EFDC model is able to simulate the ice thickness in the reservoir. The EFDC model will predict an ice cover.

Chris Holmquist-Johnson, USGS, asked if dissolved oxygen (DO) variations can be modeled in the Focus Areas (e.g., longitudinal variation of DO in Slough 8A). He also asked if the additional water quality data collected for other studies could be used in the model to detect the variations commented on in the Study 5.5 presentation by Jeff Davis, ARRI. Chris recommended a pilot study to show how the models are being applied within their temporal and special scales. Model resolution differs in the mainstem, large-scale riverine portion of the Project versus the Focus Areas in the Middle River. The issue of dissolved oxygen saturation and longitudinal variation that occurs in sloughs, commented on during the Study 5.5 presentation, was used as an example where data from multiple sources could be used to calibrate the model and detect this variation. The model is bound, regardless of the quantity of available data and spatial extent of this data, to a resolution of 500 m-1,000 m for the large-scale riverine model and to 100 m-250 m for the Focus Area models. The grid network also defines the spatial extent of the models so that extension of models further upstream into branches of sloughs is not included. These special areas of sloughs (upland sloughs) are being evaluated in other studies where habitat suitability is being investigated. Modeling of temperature, including seasonal and spatial variation, is bound by the extent of the established grid network. The grid network boundary is determined based on model performance at these boundaries.

Jeff Davis, ARRI, pointed out that in river productivity studies temperature data was collected from several macrohabitats for use in estimating algal growth, respiration, and fish growth. Two questions were asked regarding temperature data: 1) why the productivity studies generated temperature data and did not use the continuous temperature data set from baseline water quality monitoring, and 2) how many side sloughs and upland sloughs in the Middle River are included in the water quality model where temperature is predicted year-round and longitudinally? Also, how much variability is there with year-round temperature model based on the current dataset?

Jeff Davis noted there is some wide variability in water temperatures among the different macrohabitats and these are important for both fish productivity and fish growth so it's important for modeling post-project effects. The extent of water quality modeling in the main channel and side sloughs is defined by a grid network shown in several examples of the June 2014 ISR Water Quality Modeling Study (Study 5.6). Some side sloughs include a grid network and will have post-project temperature results, but at a spatial resolution of 100 meters to 250 meters. The predictive capability of the water quality temperature model may be a coarser resolution than needed by the productivity study and habitat suitability index (HSI) development. The purpose of the water quality temperature model is to supply information on a larger scale and companion to aquatic resource studies that describe conditions at a higher resolution.

William Ashton, ADEC, inquired about the operational scenarios that would be selected and the capability of withdrawal from several elevation ranges and the process for how that range would be selected. The reservoir model simulates 20 layers. The model is able to simulate water withdrawal from any of these layers. The model can be configured to allow for spillway discharge from the reservoir. There will be different operating scenarios, which can be configured to look at taking water from different strata in the reservoir. The modeling scenarios have not been developed at this point, but will be identified based on achieving temperature needs of downstream fisheries. Scenario runs for the models will be made after calibration and validation is complete and as funding allows, but no target dates have been established (Wayne Dyok, H_2O EcoPower). A run of river scenario will also be included as a water release strategy. The fully calibrated models will be completed by the USR.

5.7 Mercury Assessment and Potential for Bioaccumulation Study

Paul Dworian, AECOM, provided an overview of the objectives, components, variances, modifications, and a summary of the results. Many components of the study have been completed (e.g., data collection, preliminary pathways analysis, Harris and Hutchison Model); the remaining steps will occur after the EFDC modeling (Study 5.6) has been completed.

AEA proposes three modifications to the Study Plan (Slides 17 and 18): 1) no additional sampling will occur for the fish species that are either not present or present in only very low numbers (Humpback Whitefish, Rainbow Trout and Stickleback); 2) consolidation of all the study objectives related to tissue sampling of piscivorous wildlife for mercury analysis from other studies (10.11, 10.14, 10.15 and 10.16) within this study (Study 5.7); and 3) the need for further mercury analysis of wildlife tissue will be re-evaluated based on the predictive modeling results (reservoir and riverine models) and potential for transfer from the aquatic environment to the terrestrial environment using pathway analysis models. If piscivorous bird sampling is determined to be necessary, blood and feather samples from nestlings of the 4 target species (Bald Eagle, Common Loon, and Red-breasted and Common mergansers) will occur based on each species' abundance within the study area and the likelihood of obtaining usable samples.

Felix Kristanovich, Ramboll Environ, said he thought this study was moving in the right direction and appreciated the pathways analysis. He asked for an explanation why the 2014 mercury sampling was discontinued. He suggested that additional mercury sampling of bird feathers and mammal fur would be necessary for pathway analysis. All aquatic monitoring as indicated in the Study Plan has been completed including water column, sediment sampling, and fish tissue. This data will be used for predicting future conditions and if mercury concentrations will be elevated to a point where it could be transferred to the terrestrial animals (piscivorous birds and mammals). Additionally, the target species of birds and mammals were not commonly observed in the reservoir area. Recommendations in the September 2014 Technical Memorandum described how fish tissue concentrations based on modeling of mercury in

the reservoir will have to exceed a fish consumption threshold as reported in the presentation before there is a need to measure background terrestrial concentrations.

Felix Kristanovich, Ramboll Environ, said the validity of the pathway analysis should be supported with additional literature references, consideration of suspended solids and more complete description of the selected metals for the analysis. The preliminary mercury pathway analysis is described in Appendix A of the Study 5.7 SIR and includes a lengthy literature review and examples from other studies on how results are interpreted. The pathways analysis will be completed after the EFDC modeling (Study 5.6) and the phosphorous release modeling has been completed.

Felix Kristanovich, Ramboll Environ, recommended inclusion of a table showing the inputs to the model and the model outputs so the results can be reviewed and verified. The example, Harris and Hutchinson Model results were presented, but details for calculating output were not shown in entirety for critical review. The data used for input to the Harris and Hutchinson Model and the calculations have been provided in several documents. AEA will provide them in a single location.

Betsy McCracken, USFWS, questioned why additional work on the pathway analysis was deferred and sampling on piscivorous birds is not occurring. The pathway analysis is not being deferred, but will be guided by results from the phosphorus release model and the EFDC model. Mercury results in water and potential for bioaccumulation in fish during post-project operation will be key for making a decision on further sampling in terrestrial populations of birds and mammals. Such sampling is very challenging due to the low density of such animals in the reservoir area. If it is determined that additional sampling for piscivorous birds is warranted, blood and feather sampling of nestlings will target four piscivorous bird species (Bald Eagle, Common Loon, Red-breasted Loon, Common Merganser) based on species' abundance in the study area and the likelihood of obtaining usable samples (Slide 18).

Betsy McCracken, USFWS, asked questions about the example graphs depicting mercury concentrations over time at other reservoirs (Slide 14). The presentation of these examples from several reservoirs demonstrates the initial rise in mercury concentrations (when the reservoir is filled) and then a decline of mercury concentrations in fish tissue over time; it does not represent the Susitna Project. The source of mercury is decay of the fine organics, not the trees. The dynamic for mercury in new reservoirs is a release from the organics as vegetation is flooded. The organics can be consumed by bacteria and concentrations biomagnified through the food chain until reaching the end receptor (fish). This is demonstrated in the long-term monitoring graphs reported in the Study 5.7 SIR presentation and consistently shows a decline from between 10 and 30 years post-inundation. The minor change in concentrations of mercury in fish tissue in a mature reservoir might occur because of reservoir conditions and based on operations, hydrologic cycles, and internal cycling of nutrients (which is what mediates suspension and sequestration of mercury from sediments). These can reduce mercury concentrations in fish tissue.

Mike Wood, SRC, commented that the size of the reservoir and the vegetation type (old growth black spruce and muskeg) being submerged should be taken into account. In flooding of an area containing large trees and chunks of wood, the primary contributor to the release of mercury and bioaccumulation in fish tissue is the fine organic material in surface soils. This is because large woody debris degrades too slowly. Other factors mediate the potential for bioaccumulation of mercury in new reservoirs like availability of phosphorus. The Harris & Hutchinson model output demonstrates importance of factors like inflow patterns to the reservoir and estimates for each fish species as reported in Study 5.7 SIR, Section 5.8-1.

Monir Chowdhury, FERC, inquired if there were any quality assurance issues with sediment samples based on one high concentration of 220 ng/g from mercury sediment samples with an overall average reported of 23.01 ng/g), noting that sediment sample results were reported as much higher in the 2014 report (ISR) compared with the 2015 report (SIR). There were no quality assurance issues recorded in the report (September 2014 Study 5.7 Technical Memorandum) associated with the single high result of 220 ng/g. The result is a field duplicate from one of the other 3 sediment samples collected at the mouth of Jay Creek. This was a field duplicate sample (Sample_ID WQSDBJAY10, Lab_ID 1134503012) collected adjacent to the first sediment sample (Sample_ID WQSDBJAY01, Lab_ID 1134503011) at the mouth of Jay Creek where the original had a sediment concentration of 7.1 ng/g dw. This sample duplicate was flagged as outside of RDP acceptance limits and not further used based on the remaining two sediment samples with concentrations much lower than the sample in question and similar to each other.

Felix Kristanovich, Ramboll Environ, requested an explanation of the legend on Slide 12 of the Study 5.7 SIR presentation reporting mean size of Arctic Grayling samples and mercury concentration in fish tissue. Green symbols were data reported from the current results and the blue symbols were results from lake studies in Alaska that generated fish tissue mercury concentration results in arctic grayling. Different symbols were used to represent different areas of the proposed reservoir. Betsy McCracken, USFWS, commented that the lack of reporting of results based on mean concentration or age of fish was surprising as fish stop growing at certain ages. The accumulated concentrations of mercury in tissue data presented for other drainages represents what is available for dozens of lakes throughout Alaska and it was used to put the Susitna data in context. Unfortunately the most common species tested in Alaska was Arctic Grayling and most studies just recorded size, not age or length.

Meg Pinza, Ramboll Environ, specific to Slide 12, commented that estimates of mercury concentrations were for fish tissue versus whole body estimates. She requested that results be reported in future documents so that a comparison between the two concentrations could be made. The comment was related to converting whole body to muscle results in comparison of data between Alaska Drainages. The fish tissue results reported in the Study 5.7 SIR could be converted to express results on a whole body-basis and the numerical conversion used would be reported. This conversion may be limited to available conversion factors that have been published for fish species.

Action Item

5.7-1. AEA will provide a table of the Harris and Hutchison model inputs, outputs, and calculations. See Action Item for Study 5.7 (Attachment 9 to Transmittal of Meeting Summary and Action Items of Alaska Energy Authority, Project No. 14241-000 (filed April 24, 2016)).

7.5 Groundwater Study

Dudley Reiser, R2, Steve Swope, Pacific Groundwater Group (PGG), and Michael Lilly, Geo-Watersheds Scientific (GWS), provided an overview of the study status, variances, results, proposed modifications, and steps to complete the study as explained in the SIR and ISR Part D. AEA is not proposing any modifications to the FERC-approved Study Plan.

Several comments arose during the meeting about the model calibrations. Steve Swope, PGG, mentioned that there were a number of recommendations made in the preliminary MODFLOW report (SIR Study 7.5 Appendix B Section 7.0) that were intended to improve model calibrations. Section 7.0 includes several recommendations to improve calibration of the transient model such as the use of transient recharge, evaluation of heterogeneities in aquifer properties, and increasing the vertical and time discretization. He noted that time-steps smaller than 12 hours may be required for calibration and predictive simulations. In response to a comment (Greg Auble, USGS) regarding

linkages with the riparian study, Dawn Chapel, PGG, noted that the preliminary MODFLOW model does not include the riparian evapotranspiration package module but this can be incorporated if needed.

Jim Munter, JA Munter Consulting, indicated that he was happy to see the water table maps (SIR Appendix A), the 3-D MODFLOW model (SIR Appendix B), and the literature review (SIR Appendix C). Jim commented that the 1980s groundwater (GW) studies suggested that slough characteristics are unique, and if so, how will the upscaling be accomplished. Steve Swope, PGG, noted that more robust data sets are available and that a more sophisticated approach would be applied to using those data. Although not yet applied, overall there are a broader set of tools and a larger data set than what was available in the 1980s. It was suggested (Jim Munter and Chris Holmquist-Johnson, USGS) that the viability of the current upscaling method be tested using a pilot project to demonstrate methods and results, focusing on FA-128 (Slough 8A) first would make sense.

Comment made (Sean Egan, NMFS) that numbers of wells and pressure transducers varied among Focus Areas with FA-128 (Slough 8A) having the greatest density of instruments. Sean questioned whether the same modeling methods applied to FA-128 could be used on other Focus Areas where less data is available. Steve Swope, PGG, acknowledged this was an issue and that other Focus Areas will be evaluated on a case by case basis. For FA-115 (Slough 6A) for example, the intention would be to use a slice model rather than an aerial model. Need to consider the objectives of the GW studies at each of the Focus Areas as they differ.

Comment made (Jim Munter, NMFS contractor) about development of a conceptual model of the system that defines basic processes. This relates to storage coefficients. The numbers applied to date reflect a semi-confined area, but there is no evidence of that. The values actually used need to be reconciled with the model and empirical data. Steve Swope, PGG, acknowledged the comment.

Comment raised (Melissa Hill, DNR) about recharge constants and the need to have discharge and recharge at the same scale. If the discharge and recharge and time steps do not line up, then the results will not be meaningful. Steve Swope, PGG, noted that it depends on the output. The intent is to develop small scale Surface Water (SW)/GW relationships. Changes in gradient with river and SW flows are a result of SW events. In general GW flows from the aquifer into the river. During an SW event, SW stage rises, water pushes back to the aquifer, stage recedes, and then gradient reverses. The intent of the model is to look at those relationships close to the river and the effect of gradient reversals on temperature. Steve Swope noted that it will be unlikely to have recharge on an hourly basis because GW responses are slower than SW responses and that more analysis is needed.

Question raised (Melissa Hill, DNR) about use of TIR imagery. Steve Swope, PGG, noted the TIR maps will provide qualitative input into the thermal analysis as well as indicators of upwelling in areas outside of Focus Areas.

Comment raised (Chris Holmquist-Johnson, USGS) that there is a need to understand how model output will support other studies. Steve Swope, PGG, noted that further refinements to the FA-128 (Slough 8A) model will include documentation and demonstration of how model output will support other studies.

Comment made (Tim Ruga, AKRF) regarding the use of a uniformly thick aquifer – 100 ft thick in the model. Appears to be a detailed model on the surface but beneath the model operates as a black box – i.e., don't know where bedrock is. Steve Swope, PGG, noted they applied the data available. There aren't any deep well borings so went with literature information. He mentioned we are looking at processes fairly close to the river itself and some of the deeper processes can be considered as far-field similar to up and downgradient parts of the model; i.e. further away, less likely Project to have impacts. If data from the deeper part of the aquifer becomes available that information could be incorporated during model refinement.

Comment made (Tim Ruga, AKRF) regarding calibration differences between wells proximal to water bodies and the interior wells. Steve Swope, PGG, noted that model calibration is not yet complete. The intent is to calibrate wells

further away and spend more time looking at aquifer properties instead of using single variables throughout the entire model.

Comment made (Tim Ruga, AKRF) about possibility of transient model calibration event being associated with overtopping of the bank of the Susitna River. Information suggests more than just recharge from precipitation but possibly overtopping of the river during the calibration period introducing flow into the islands and infiltration into the wells. Steve Swope, PGG, appreciated comment and indicated will be looking at 2015 data and is optimistic this will afford better calibrations. Transient calibration to time periods that include flux data (i.e., seepage surveys) could improve the calibration and will be considered during model refinement.

Comment made (Tim Ruga, AKRF) voicing concern about the removal of instruments that may be needed to provide for better calibrations.

Action Item

7.5-1. It was noted that the MODFLOW model development data was not completely available on the GINA site at the time of the meeting. It has since been updated to include stations ESGFA128-4, ESGFA128-5, ESGFA128-6 and ESGFA128-7 (http://gis.suhydro.org/suwareports/SIR/07-Hydrology/7.5-Groundwater/SIR_7_5_Appendix_B_MODFLOW/). The following stations were used as targets either in the steady-state or transient model calibrations as listed in Study 7.5 SIR Appendix B Table 4.1 of the preliminary MODFLOW report:

- ESGFA128-2-W1
- ESGFA128-4-W1
- ESGFA128-5-W1
- ESGFA128-6-W1
- ESGFA128-7-W1
- ESGFA128-11-W1
- ESGFA128-13-W1
- ESGFA128-18-W1
- ESGFA128-19-W1
- ESGFA128-21-W1
- ESGFA128-23-W1
- ESGFA128-24-W1
- ESGFA128-25-W1
- ESGFA128-26-W1
- ESGFA128-27-W1

7.5-2. The question was raised during the meeting regarding whether a bank overtopping event occurred during the transient calibration period of the MODFLOW. AEA confirmed that the flows used in the calibration process (provided via the SRH-2D model) included overtopping conditions.